

CLAIM

Having thus described the invention we claim as new and desire to secure by Letters Patent:

1       ✓ 1. An electrically conductive polymer blend com-  
2 position comprising the reaction product of an electri-  
3 cally conductive polymer in undoped form and a  
4 polydopant.

1               2. The electrically conductive polymer blend  
2 composition defined in claim 1 wherein said polymers in-  
3 teract at a plurality of sites along the length of said  
4 polymer thereby resulting in a molecularly compatible  
5 blend.

1               3. The electrically conductive polymer blend  
2 composition defined in claim 2 wherein said electrically  
3 conducting polymer complexes with said polydopant.

1               4. The electrically conductive polymer blend  
2 composition defined in claim 3 wherein one of said  
3 polymers is a rigid polymer.

1               5. The electrically conductive polymer blend  
2 composition defined in claim 3 wherein said electrically  
3 conductive polymer is selected from the group consisting  
4 of substituted and unsubstituted  
5 polyparaphenylenevinylenes, polyanilines, polyazines,  
6 polythiophenes, poly-p-phenylene sulfides, polyfuranes,

6 polypyrroles, polyselenophenes, polyacetylenes formed  
7 from soluble precursors and combinations and blends  
8 thereof.

1 6. The electrically conductive polymer blend  
2 composition defined in claim 5 wherein said polydopant is  
3 a dielectric polymer containing Lewis acid functionality.

1 7. The electrically conductive polymer blend  
2 composition defined in claim 6 wherein said Lewis acid  
3 functionality reacts with said electrically conductive  
4 polymer in undoped form to convert said conducting  
5 polymer to the doped form.

1 8. The electrically conductive polymer blend  
2 composition defined in claim 7 wherein said polydopant is  
3 selected from the group consisting of polyacrylic acids,  
4 polysulfonic acid, cellulose sulfonic acid, polyamic  
5 acid, polyphosphoric acid, polymers containing acid  
6 chloride groups ( $-\text{CO}-\text{Cl}$ ) and polymers containing sulfonyl  
7 chloride groups ( $-\text{SO}_2\text{Cl}$ ).

1 9. The electrically conductive polymer blend  
2 composition defined in claim 8 wherein said polydopant is  
3 polyamic acid that is photosensitive.

1 10. The electrically conductive polymer blend  
2 composition defined in claim 8 wherein said electrically  
3 conductive polymer is polyaniline and said polydopant is

4 polyamic acid.

1 11. The electrically conductive polymer blend  
2 composition defined in claim 8 wherein said electrically  
3 conductive polymer is polythiophene and said polydopant  
4 is a polyacrylic acid.

1 12. The electrically conductive polymer blend  
2 composition defined in claim 8 that is in form of a gel.

1 13. The electrically conductive polymer blend  
2 composition defined in claim 8 that is formed into a  
3 shaped article.

1 14. The electrically conductive polymer blend  
2 composition defined in claim 13 wherein the shaped arti-  
3 cle is a fiber.

1 15. An electrically conducting polymer blend  
2 composition comprising an electrically conductive polymer  
3 in undoped form, a dielectric polymer and a thermally  
4 deblockable dopant.

1 16. The electrically conducting polymer blend  
2 composition defined in claim 15 wherein said electrically  
3 conductive polymer is selected from the group consisting  
4 of substituted and unsubstituted polyparaphen-  
5 lenevinylenes, polyanilines, polyazines, polythiophenes,  
6 poly-p-phenylene sulfides, polyfuranes, polypyrroles,  
7 polyselenophenes, polyacetylenes formed from soluble

precursors and combinations and blends thereof.

17. The electrically conducting polymer blend composition defined in claim 15 wherein said dielectric polymer is selected from the group consisting of interpolymers of acrylonitrile-butadiene-styrene, acetal acrylic liquid crystal polymers, polybutylene terephthalate, polycarbonate, polyester, polyetherimide, polyethersulfone, polyethylene, polyethylene terephthalate, polyphenylene oxide polyphenylene sulfide, polypropylene, polystyrene, polyurethane, polyvinyl chloride, styrene-acrylonitrile copolymer fluoropolymers, nylon polyesters and thermoplastic elastomer.

18. The electrically conducting polymer blend composition defined in claim 15 wherein said thermally deblockable dopants are selected from the group consisting of triflates, tosylates and borates.

19. The electrically conducting polymer blend composition defined in claim 15 wherein said triflates, tosylates and borates are selected from the group consisting of  $\text{CF}_3\text{SO}_3\text{H}$ ,  $\text{NC}_5\text{H}_5$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{NH}_3$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{CH}_3\text{NHC}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{CH}_3)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_2\text{NH}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} - \text{C}_3\text{H}_7)_2\text{NH}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HNC}_4\text{H}_8\text{O}$ ,

9  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_5\text{H}_{10}$ ,  
10  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HN}(\text{C}_2\text{H}_4\text{OH})_2$ ,  $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$ ,  
11  $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$ .

1 20. The electrically conducting polymer blend  
2 composition defined in claim 15 wherein said dielectric  
3 polymer is selected from the group consisting of inter-  
4 polymers of acrylonitrile-butadiene-styrene, acetal  
5 acrylic liquid crystal polymers, polybutylene terephtha-  
6 late, polycarbonate, polyester, polyetherimide,  
7 polyethersulfone, polyethylene, polyethylene terephtha-  
8 late, polyphenylene oxide, polyphenylene sulfide,  
9 polypropylene, polystyrene, polyurethane, polyvinyl  
10 chloride, styrene-acrylonitrile copolymer and  
11 thermoplastic elastomer; and said thermally deblockable  
12 dopants are selected from the group consisting of  
13  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NC}_5\text{H}_5$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NH}_3$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{CH}_3\text{NHC}$ ,  
14  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{CH}_3)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_2\text{NH}$ ,  
15  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{NH}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} -$   
16  $\text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  
17  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_4\text{H}_8\text{O}$ ,  
18  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_5\text{H}_{10}$ ,  
19  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HN}(\text{C}_2\text{H}_4\text{OH})_2$ ,  $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$ ,  
20  $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$ .

1 21. The electrically conducting polymer blend

2 composition defined in claim 20 wherein said electrically  
3 conductive polymer is polyaniline, said dielectric  
4 polymer is polycarbonate and said thermally deblockable  
5 dopant is diethylamine triflate.

1 22. The electrically conducting polymer blend  
2 composition defined in claim 20 wherein the electrically  
3 conductive polymer is polythiophene said dielectric  
4 polymer is nylon and said thermally deblockable dopant is  
5  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ .

1 23. The electrically conductive polymer blend  
2 composition comprising: a frustrated blend of polyimide  
3 and an electrically conductive polymer selected from the  
4 group consisting of substituted and unsubstituted  
5 polyparaphenylenevinylenes, polyanilines, polyazines,  
6 polythiophenes, poly-p-phenylene sulfides, polyfuranes,  
7 polypyrroles, polyselenophenes, polyacetylenes formed  
8 from soluble precursors and combinations and blends  
9 thereof.

1 24. A conductive shaped article comprising:  
2 a doped electrically conductive polymer  
3 material in admixture with a dielectric polymer material.

4 25. The shaped article defined in claim 24,  
5 wherein said electrically conductive polymer material is  
6 in the form of a fiber.

1           26. The shaped article defined in claim 24,  
2 wherein said body is selected from the group consisting  
3 of a crystalline solid, an amorphous solid, a  
4 polycrystalline solid a semicrystalline solid and a  
5 glass.

1           27. The shaped article defined in claim 24 fur-  
2 ther including an anion of a doping agent.

3           28. The shaped article defined in claim 24,  
4 wherein said dielectric polymer material is an anion of  
5 polymeric carboxylic acid.

1           29. The shaped article defined in claim 24 that  
2 has been shaped into a stylus suitable for use in resis-  
3 tive film digitizer.

1           30. A method comprising: providing a shaped ar-  
2 ticle of the material of claim 24, thereupon applying a  
3 bias thereto to deposit another composition thereon using  
4 a method selected from the group consisting of elec-  
5 trostatic and electrochemical deposition.

1           31. A method of preparing an electrically con-  
2 ductive intercalated molecular polymer blend composition  
3 comprising blending a polydopant with a conducting  
4 polymer in undoped form, to obtain a uniform dispersion  
5 at a molecular scale as a result of an interaction along  
6 the length of said polymer.

1           32. The method of preparing the electrically  
2           conductive polymer blend defined in claim 31, wherein  
3           said polydopant is a Lewis acid polymer.

1           33. The method of preparing the electrically  
2           conductive polymer blend defined in claim 32, wherein  
3           said Lewis acid polymer is selected from the group con-  
4           sisting of polymeric acid, polysulfonic acid, cellulose  
5           sulfonic acid, polyamic acid, photosensitive polyamic  
6           acid, polyphosphoric acid, acid chloride containing  
7           polymers and sulfonyl chloride containing polymers.

1           34. The method of preparing the electrically  
2           conductive polymer blend defined in claim 31, wherein  
3           said conducting polymer is selected from the group con-  
4           sisting of substituted and unsubstituted  
5           polyparaphenylenevinylenes, polyanilines, polyazines,  
6           polythiophenes, poly-p-phenylene sulfides, polyfuranes,  
7           polypyrroles, polyselenophenes, polyacetylenes formed  
8           from soluble precursors and combinations and blends  
9           thereof.

1           35. The method of preparing the electrically  
2           conductive polymer blend defined in claim 34, wherein  
3           said Lewis acid polymer is selected from the group con-  
4           sisting of polymeric acid, polysulfonic acid, cellulose  
5           sulfonic acid polyamic acid, photosensitive polyamic



6 acid, polyphosphoric acid, acid chloride containing  
7 polymers and sulfonyl chloride containing polymers.

1 36. The method of preparing the electrically  
2 conductive polymer blend defined in claim 35, wherein the  
3 conducting polymer is polyanilene and said Lewis acid  
4 polymer is polyamic acid.

1 37. A method of preparing the electrically con-  
2 ducting polymer system comprising blending a conductive  
3 polymer in undoped form with a dielectric polymer and a  
4 thermally deblockable dopant, and heating said blend to  
5 obtain a conductive blend.

1 38. The method of preparing the electrically  
2 conductive polymer system defined in claim 37, wherein  
3 said electrically conductive polymer is selected from the  
4 group consisting of substituted and unsubstituted  
5 polyparaphenlenevinylenes, polyanilines, polyazines,  
6 polythiophenes, poly-p-phenylene sulfides, polyfuranes,  
7 polypyrroles, polyselenophenes, polyacetylenes formed  
8 from soluble precursors and combinations and blends  
9 thereof.

1 39. The method of preparing the electrically  
2 conductive polymer system defined in claim 37, wherein  
3 said dielectric polymer is selected from the group con-  
4 sisting of interpolymers of acrylonitrile-butadiene-

5 styrene, acetal acrylic liquid crystal polymers,  
6 polybutylene terephthalate, polycarbonate, polyester,  
7 polyetherimide, polyethersulfone, polyethylene,  
8 polyethylene terephthalate, polyphenylene oxide  
9 polyphenylene sulfide, polypropylene, polystyrene,  
10 polyurethane, polyvinyl chloride, styrene-acrylonitrile  
11 copolymer and thermoplastic elastomer.

1 40. The method of preparing the electrically  
2 conductive polymer system defined in claim 37, wherein  
3 said thermally deblockable dopant is selected from the  
4 group consisting of triflates, tosylates and borates.

1 41. The method of preparing the electrically  
2 conductive polymer system defined in claim 39, wherein  
3 said triflates, tosylates and borates are selected from  
4 the group consisting of  $\text{CF}_3\text{SO}_3\text{H}$ ,  $\text{NC}_5\text{H}_5$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{NH}_3$ ,  
5  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{CH}_3\text{NHC}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{CH}_3)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{C}_2\text{H}_5\text{NH}_2$ ,  
6  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_2\text{NH}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} -$   
7  $\text{C}_3\text{H}_7)_2\text{NH}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} -$   
8  $\text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HNC}_4\text{H}_8\text{O}$ ,  
9  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$ ,  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HNC}_5\text{H}_{10}$ ,  
10  $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HN}(\text{C}_2\text{H}_4\text{OH})_2$ ,  $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$ ,  
11  $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$ .

1 42. The method of preparing the electrically  
2 conductive polymer system defined in claim 38, wherein

3 said dielectric polymer is selected from the group con-  
4 sisting of interpolymers of acrylonitrile-butadiene-  
5 styrene, acetal acrylic liquid crystal polymers,  
6 polybutylene terephthalate, polycarbonate, polyester,  
7 polyetherimide, polyethersulfone, polyethylene,  
8 polyethylene terephthalate, polyphenylene oxide,  
9 polyphenylene sulfide, polypropylene, polystyrene,  
10 polyurethane, polyvinyl chloride, styrene-acrylonitrile  
11 copolymer and thermoplastic elastomer; and said thermally  
12 deblockable dopants are selected from the group consist-  
13 ing of  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NC}_5\text{H}_5$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NH}_3$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{CH}_3\text{NHC}$ ,  
14  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{CH}_3)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_2\text{NH}$ ,  
15  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_3\text{N}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{NH}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} -$   
16  $\text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  
17  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_4\text{H}_8\text{O}$ ,  
18  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$ ,  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_5\text{H}_{10}$ ,  
19  $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HN}(\text{C}_2\text{H}_4\text{OH})_2$ ,  $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$ ,  $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$ ,  
20  $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$ .

1 43. The method of preparing the electrically  
2 conducting polymer blend defined in claim 35 wherein the  
3 blend is formed into a conductive gel in dilute solution  
4 which is formed into a shaped article.

1 44. The method of preparing the electrically  
2 conducting polymer system defined in claim 35 wherein

3 said blend is processed in the solid state.

1 45. The method defined in claim 43 wherein said  
2 shaped article is a fiber.

1 46. The method defined in claim 43 wherein said  
2 shaped article is a film.

1 47. The method defined in claim 43 wherein said  
2 shaped article is a body.

1 48. A method comprising applying a conducting  
2 polymer to the surface of a non conducting shaped arti-  
3 cle.

1 49. The method defined in claim 48 wherein said  
2 conducting polymer is solution deposited.

1 50. The method defined in claim 48 wherein said  
2 conducting polymer is vapor deposited.

1 51. The method defined in claim 48 wherein said  
2 conducting polymer is electrochemically deposited.

1 52. The method defined in claim 48 wherein said  
2 conducting polymer is deposited by adsorption.

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a1

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B

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G.2

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G.3

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H.1

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H.2

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e 1 + e 2